

condition in which they are present. A soil however, which would contain no other substances but pure sand, clay, peroxyd of iron, lime and humus, and even these in such a proportion as is considered the most proper, would be in spite of the highest culture entirely sterile. In the following section we shall become acquainted with a series of substances which are essential to vegetable life, inasmuch as they are required by plants as nourishment; and as they can be supplied by no other means than by the soil itself, they must be present in it whenever the soil exercises fertilizing properties. This series of substances includes all those in soils which by their chemical character belong to the class of salts, and which are more or less soluble in rain water, and by means of their solution therefore capable of entering into the organization of plants; the fundamental ingredients of soil show in every respect quite a different character, as already stated. These salts consist principally of the following: alkaline salts, (potash and soda,) earthy salts, (lime and magnesia,) phosphates, (salts of phosphoric acid,) sulphates, (salts of sulphuric acid,) chlorides, (salts of hydrochloric acid,) and silicates, (salts of silicic acid.)

Total sterility of a soil, as we supposed it in the foregoing, rarely exists in reality, inasmuch as the absolute absence of soluble substances, can only be in a field which would entirely consist of fine quartz sand; the presence of clay and humus, includes at the same time that of alkaline salts, some of which are always retained by them, so that a chemically pure clay and a chemically pure humus, never exist in soils. The former will never become totally decomposed, and the latter will always retain some of these substances as long as it is present itself, and not totally transformed into carbonic acid and water. It may happen that a soil, which consists of the fundamental ingredients and from which a series of crops were taken, does show only traces of those nourishing substances, or even none at all, when they are to be extracted by water; but this state does not indicate that of absolute sterility, but merely that of temporary sterility, inasmuch as it yet contains nourishing substances, which, however, are retained by clay and humus in such a form that water may not extract them. After several following seasons, by exposure to the air, which may be increased by mechanical loosening of the earth, by deepening of the soil, &c., the fertility of the soil may be restored, in consequence of the advanced disintegration of clay and humus, by which new quantities of soluble substances become liberated.

We have in the foregoing considered the important part which the fundamental ingredients of soil take in the development of plants, inasmuch as it depends on their relative proportion and on the condition in which they are present, as a soil is more or less fit to offer those supports which vegetable life requires. In the following I shall endeavor to explain, how the quantity of solu-